What is claimed is:

1. A method of fabricating a gated field emission structure including nanowire electron emitters comprising the steps of:

forming on a substrate an array of spaced apart catalyst metal nano islands;

coating the nano islands with a coating of protective material;

forming a cathode structure having an array of gate apertures in registration with the coated nano islands so that the nano islands are localized near the centers of the apertures;

removing the protective coating from the nano islands; and

growing nanowires from the exposed nano islands from the exposed catalyst nano islands, the nanowires localized near the center of the apertures.

2. The method of claim 1 wherein the number of nanowires within each aperture is 10 or less.

3. The method of claim 1 wherein a single nanowire is grown within each of a plurality of apertures.

4. The method of claim 1 wherein the nanowires are grown from the nano islands by chemical vapor deposition.

5. The method of claim 1 wherein the nanowires are grown in the presence of an electrical field substantially perpendicular to the substrate.

6. A method of fabricating a gated field emission structure including nanowire electron emitters comprising the steps of:

growing an array of nanowires on a substrate by CVD process, the nanowires grown as spaced apart individual nanowires or spaced apart groups of less than 10 nanowires;

coating the nanowires with a coating of protective material;

depositing a dielectric layer over the coated nanowires;

planarizing the dielectric layer to expose emitting tips of the nanowires; and

forming a gate electrode over the dielectric with an array of gate apertures in registration with the exposed emitter tips.

7. The method of claim 6 wherein the nanowires are coated with protective material through a shadow mask.

8. A method of fabricating a gated emission structure including nanowire electron emitters comprising the steps of:

forming on a substrate an emitter cathode structure including a gate electrode array having an array of gate apertures;

depositing in each gate aperture a catalyst nano islands to form one or a small group of less than 10 centrally located nanowires;

applying an electrical field substantially perpendicular to the substrate; and

growing nanowires from the nano islands by CVD process.

9. The method of claim 8 wherein the nano islands are deposited through a shadow mask with openings in registration with the gate apertures.

10. The methods of claim 9 wherein the elelctrical field is applied between the gate electrodes and the substrate.

11. The method of claim 8 wherein the cathode structure further comprises a focusing electrode array and the electrical field is applied between the focusing electrodes and the substrate.

12. The method of claim 1 further comprising the step of adhering the nanowires to the substrate.

13. The method of claim 6 further comprising the step of adhering the nanowires to the substrate.

14. The method of claim 8 further comprising the step of adhering the nanowires to the substrate.

15. An electron beam emitting source comprising:

a gated field emission structure comprising an array of gated electron emission cells, each cell comprising an emitter support element, a gate electrode

structure, a gate aperture and one or more nanowire electron emitters disposed on the support element and centrally positioned within the gate aperture, the total number of emitters in each cell limited to 10 or fewer.

16. The source of claim 15 wherein the total number of emitters in each cell is limited to 3 or fewer.

17. The source of claim 15 wherein the number of emitters in each cell is 1.

18. The source of claim 15 wherein each nanowire electron emitter is tapered from a thickest diameter portion to a sharp tip having a radius of curvature less than 1/10 of the thickest diameter.

19. The source of claim 15 wherein the gate electrode structure is patterned into an array of gates so that each gate can apply an electron-exacting voltage to a respective emission cell.

20. The source of claim 15 wherein each cell comprises a directional control element to control the direction of an emitted beam.

21. The source of claim 20 wherein the emitter support element in each cell is movable and the directional control element comprises the movable emitter support element.

22. The source of claim 20 wherein each emitter is supported on a movably mounted MEMS disc and the directional control element controls the orientation of the MEMS disc.

23. The source of claim 20 wherein the directional control element comprises a plurality of electrodes adjacent the manowire emitters for controlling the direction of emitted electrons.

24. A method of exposing selected portions of a surface to electrons comprising the steps of:

providing a plurality of gated emitter cells with centralized nanowire emitters;

inducing electron beams from the emitters; and

separately controlling the directions of the beams to direct the beams to the selected portions of the surface.

25. The method of claim 24 wherein the beam directions are separately controlled by separately controlling the orientations of the nanowire emitters.

26. The method of claim 24 wherein the beam directions are separately controlled by separately deflecting the emitted beams.

27. The method of exposing selected portions of a surface to electrons comprising the steps of:

providing a plurality of gated emitter cells with centralized nanowire emitters;

inducing electron beams from the emitters; and

controlling the direction of the beams emitted by the plurality of cells.

28. The method of claim 27 wherein the direction of the beams is controlled by controlling the orientation of the plurality of cells.

29. A method of exposing selected portions of a surface to electrons comprising the steps of:

providing a source of electron beams comprising a plurality of gated emitter cells with centralized nanowire emitters;

disposing an electron beam mask between the source and the surface; and

inducing electron beams from the emitters toward the surface.

30. The method of exposing a surface to electrons comprising the steps of:

providing a source of electron beams comprising a plurality of gated emitter cells with centralized nanowire emitters; and

inducing electron beams from the emitters toward the surface.

31. The method of claim 24 wherein the surface comprises a substrate supporting a phosphor or an electron beam resist.

32. The method of claim 27 wherein the surface comprises a substrate supporting a phosphor or an electron beam resist.

33. The method of claim 29 wherein the surface comprises a substrate supporting an electron beam resist.

34. The method of claim 30 wherein the surface comprises an electron beam mask or an x-ray generating metal.

35. An arrangement for performing electron beam lithography comprising:

a surface comprising an electron beam resist; and

a device according to claim 15 for exposing selected portions of the surface to electrons.

36. An arrangement for performing electron beam lithography comprising:

a surface comprising an electron beam resist; and

a device according to claim 17 for exposing selected portions of the surface to electrons.

37. An arrangement for performing electron beam lithography comprising:

a surface comprising an electron beam resist; and

a device according to claim 20 for exposing selected portions of the surface to electrons.

38. An arrangement for performing electron beam lithography comprising:

an electron beam emitting source comprising a plurality of gated emitter cells with centralized nanowire emitters;

a surface comprising an electron beam resist and

a electron beam mask disposed between the gated emitter cells and the surface.

39. The arrangement of claim 38 wherein the total number of emitters in each cell is limited to 10 or fewer.

40. The arrangement of claim 38 wherein the emitter cells are disposed in a periodic array.

41. A visual display apparatus comprising:

a surface comprising a phosphor for generating light in response to electrons; and

a device according to claim 15 for exposing selected portions of the surface to electrons.

42. A visual display apparatus comprising:

a surface comprising a phosphor for generating light in response to electrons; and

a device according to claim 17 for exposing selected portions of the surface to electrons .

43. A visual display apparatus comprising:

a surface comprising a phosphor for generating light in response to electrons; and

a device according to claim 20 for exposing selected portions of the surface to electrons

44. An arrangement for generating x-ray radiation comprising:

a electron beam emitting source comprising a plurality of gated emitter cells with centralized nanowire emitters; and

a surface comprising metal for generating x-rays in response to electrons.

45. In an improved microwave amplifier comprising a cathode electron emitter, a grid, an anode, a tail pipe and a collector,

the improvement wherein the cathode electron emitter comprises an electron beam emitting source according to claim 15.

46. In an improved microwave amplifier comprising a cathode electron emitter, a grid, an anode, a tail pipe and a collector,

the improvement wherein the cathode electron emitter comprises an electron beam emitting source according to claim 17.